

In the claims:

Please withdraw claims 16-23 as follows:

- 5 1. (original) A manufacturing process for making a surface-mountable printed-circuit board (PCB) module comprising:
etching inner metal layers on both sides of an insulating core to form patterned
interconnect on the inner metal layers;
laminating a component metal sheet and a component insulator layer over one of the
10 inner metal layers;
laminating a pad metal sheet and a sacrificial insulator layer over another one of the inner
metal layers;
etching the component metal sheet to form patterned component-layer interconnect from
the component metal sheet;
15 etching a pad metal layer of the pad metal sheet to form solder pads from the pad metal
sheet;
drilling castellation vias on the pad metal layer, and forming metal inside the castellation
vias that connect the pad metal layer to the patterned component-layer
interconnect or the patterned interconnect on the inner metal layers;
20 milling a cavity into the sacrificial insulator layer, the cavity not reaching the patterned
interconnect on the inner metal layers; and
wherein the sacrificial insulator layer covered by the solder pads forms a plurality of
stand-offs after milling,
whereby the solder pads on the stand-offs are surface-mountable to a main board.
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2. (original) The manufacturing process of claim 1 further comprising:
milling the sacrificial insulator layer between adjacent solder pads to further form the
plurality of stand-offs.
- 30 3. (original) The manufacturing process of claim 2 wherein drilling castellation vias is
performed before etching the pad metal layer to form the solder pads.

4. (original) The manufacturing process of claim 2 wherein drilling castellation vias is performed after etching the pad metal layer to form the solder pads.

5 5. (original) The manufacturing process of claim 1 wherein etching the pad metal layer to form solder pads from the pad metal sheet comprises:
plating copper and tin on exposed areas of the pad metal sheet;
removing resist from covered areas of the pad metal sheet;
wherein exposed areas have a tin over copper while covered areas have no tin over the
10 copper;
etching copper from the covered areas but not etching copper from the exposed areas
protected by tin; and
removing tin covering copper in the exposed areas to form the solder pads.

15 6. (original) The manufacturing process of claim 1 further comprising:
applying a solder mask to the solder pads with openings over each of the solder pads;
applying solder to the openings in the solder mask to apply solder to the solder pads; and
removing the solder mask.

20 7. (original) The manufacturing process of claim 1 further comprising:
de-panelization by cutting de-panelization lines between adjacent PCB modules on a
panel having a plurality of the PCB modules being formed together.

8. (original) The manufacturing process of claim 7 wherein the castellation vias are
25 formed along the de-panelization lines, wherein each castellation via is partly in one of
the de-panelization lines and partly on one of the solder pads.

9. (original) The manufacturing process of claim 8 further comprising:
finishing the castellation vias during de-panelization by rounding or smoothing edges of
30 the castellation vias.

10. (original) The manufacturing process of claim 9 wherein milling the cavity is performed along with de-panelization on a same machine.

11. (original) The manufacturing process of claim 1 wherein milling the cavity is performed by moving a rotating drill or router bit over the sacrificial insulator layer to cut away a portion of the sacrificial insulator layer.

12. (original) The manufacturing process of claim 11 wherein the sacrificial insulator layer is thicker than the component insulator layer.

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13. (original) The manufacturing process of claim 11 further comprising:
drilling inner vias between the inner metal layers and plating the inner vias to form inter-layer interconnect between the inner metal layers.

14. (original) The manufacturing process of claim 13 further comprising:
mounting and soldering components to the patterned component-layer interconnect,
wherein the components are integrated circuits and capacitors or resistors.

15. (original) The manufacturing process of claim 14 further comprising:
surface-mounting the PCB module to a main board by placing the solder pads over pad metal areas of the main board and heating to solder the solder pads to the pad metal areas.

16. (withdrawn) A product made by the process of claim 1.

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17. (withdrawn) A printed-circuit board (PCB) module comprising:
multiple metal layers patterned into interconnect traces, each metal layer separated from other metal layers by one or more insulator layers;
metalized vias through the one or more insulator layers to form inter-layer interconnect;
a sacrificial insulator layer between a bottom one of the multiple metal layers and a pad-metal layer;

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a plurality of stand-offs formed from the sacrificial insulator layer, each of the plurality of stand-offs having a solder pad on an outer surface;

a plurality of castellation vias each connecting a solder pad to one or more of the interconnect traces on one or more of the multiple metal layers; and

- 5 a cavity in the sacrificial insulator layer, the cavity formed between the plurality of stand-offs, the cavity having a reduced-thickness portion of the sacrificial insulator layer to prevent exposing any of the interconnect traces on the multiple metal layers.

18. (withdrawn) The PCB module of claim 17 further comprising:

- 10 an integrated circuit component mounted to some of the interconnect traces on a component side opposite a bottom side having the cavity and the solder pads.

19. (withdrawn) The PCB module of claim 17 wherein the cavity and the plurality of stand-offs are formed by milling away portions of the sacrificial insulator layer.

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20. (withdrawn) The PCB module of claim 19 wherein each of the plurality of castellation vias is an open via on an edge of the PCB module.

21. (withdrawn) The PCB module of claim 20 wherein the one or more insulator layers comprise epoxy-fiberglass insulator layers.

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22. (withdrawn) The PCB module of claim 21 wherein the cavity is between rows of the solder pads.

23. (withdrawn) The PCB module of claim 22 wherein each solder pad is on a separate stand-off.

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